

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

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Claim 1 (Original)      An apparatus for helping to protect a vehicle occupant, comprising:

        an actuatable vehicle occupant protection device;

and

        a microelectromechanical system device (MEMS device) energizable to cause actuation of said protection device.

Claim 2 (Original)      An apparatus as set forth in claim 1 wherein said MEMS device is an energizable fluid source for emitting a primary fluid for actuating said protection device.

Claim 3 (Original)      An apparatus as set forth in claim 2 wherein said protection device is an inflatable device and said apparatus includes means for directing said primary fluid from said MEMS device into said inflatable device to inflate said inflatable device.

Claim 4 (Original)      An apparatus as set forth in claim 3 comprising a plurality of said MEMS devices and including means for directing said primary fluid from said MEMS devices into said inflatable device to inflate said inflatable device, said plurality of MEMS devices being

individually actuatable to control inflation of said protection device.

Claim 5 (Original)      An apparatus as set forth in claim 4 wherein said plurality of MEMS devices are individually actuatable at different times to control inflation of said protection device.

Claim 6 (Withdrawn)      An apparatus as set forth in claim 4 wherein said plurality of MEMS devices are individually actuatable to control the direction of inflation of said protection device.

Claim 7 (Original)      An apparatus as set forth in claim 2 wherein said MEMS device includes a solid pyrotechnic material which is ignited upon energizing of said MEMS device to produce said primary fluid.

Claim 8 (Withdrawn)      An apparatus as set forth in claim 2 wherein said MEMS device includes a quantity of fluid under pressure which is heated upon energizing of said MEMS device to cause emission of said primary fluid.

Claim 9 (Withdrawn)      An apparatus as set forth in claim 1 wherein said actuatable vehicle occupant protection device includes a rupturable portion and said MEMS device is energizable to rupture said rupturable portion.

Claim 10 (Withdrawn)      An apparatus as set forth in claim 9 comprising at least one additional MEMS device which is energizable to help to rupture said rupturable portion.

Claim 11 (Original)      An apparatus as set forth in claim 1 comprising a plurality of said MEMS devices and including means for selectively controlling whether and when each one of said MEMS devices is energized.

Claim 12 (Withdrawn)      An apparatus as set forth in claim 2 comprising means for directing said primary fluid from said MEMS device to a secondary fluid source to actuate said secondary fluid source to provide secondary fluid for actuating said protection device.

Claim 13 (Withdrawn)      An apparatus as set forth in claim 12 wherein said MEMS device is at least a portion of an initiator for an augment inflator.

Claim 14 (Withdrawn)      An apparatus as set forth in claim 12 wherein said MEMS device is at least a portion of an initiator for a heated gas inflator.

Claim 15 (Original)      An apparatus comprising:  
                                an actuatable vehicle occupant protection device;  
                                at least one multi-layered device including:  
                                an outer layer having a plurality of individually rupturable segments;

a middle layer having a plurality of individual chambers associated in a one-to-one relationship with said rupturable segments of said outer layer and being closed by said rupturable segments, each one of said chambers having contents heatable to increase the pressure in said chamber; and

a base layer having a plurality of individually energizable electric heating elements associated in a one-to-one relationship with said chambers for, when energized, heating the contents of said chambers;

each one of said rupturable segments being rupturable due to an increase in pressure in its associated chamber to enable flow of fluid out of said chamber; and

means for selectively energizing said individually energizable electric heating elements.

Claim 16 (Original)      An apparatus as set forth in claim 15 wherein said heatable contents comprises a pyrotechnic material which is ignitable to produce fluid under pressure.

Claim 17 (Withdrawn)      An apparatus as set forth in claim 15 wherein said heatable contents comprises a fluid under pressure which is heatable to increase its pressure.

Claim 18 (Original)      An apparatus as set forth in claim 15 wherein said electric heating elements are micro-resistors.

Claim 19 (Original)      An apparatus as set forth in  
claim 15 wherein said protection device is an air bag.

Claim 20 (Withdrawn)      An apparatus as set forth in  
claim 15 wherein said multi-layered device is an initiator for  
a fluid-generating apparatus.

Claim 21 (Original)      An apparatus as set forth in  
claim 15 wherein said multi-layered device is energizable to  
generate a primary fluid for actuating said protection device.

Claim 22 (Withdrawn)      An apparatus as set forth in  
claim 15 wherein said electric heating elements are reactive  
bridges.

Claim 23 (Withdrawn)      An apparatus comprising:  
        an inflatable vehicle occupant protection device;  
and  
        an inflator for inflating said protection device,  
        said inflator comprising an actuatable primary  
inflation fluid source for providing inflation fluid, a  
secondary inflation fluid source, and at least one  
microelectromechanical system device (MEMS device) energizable  
to produce combustion products for actuating or augmenting  
said primary inflation fluid source.

Claim 24 (Withdrawn)      An apparatus as set forth in  
claim 23 wherein said inflator is a heated gas inflator, said

actuatable primary inflation fluid source is a fluid mixture comprising an inert gas component and a fuel gas component, and said MEMS device is energizable to produce combustion products for igniting said fuel gas component of said fluid mixture.

Claim 25 (Withdrawn)      An apparatus as set forth in claim 23 wherein said actuatable primary inflation fluid source comprises stored gas and said MEMS device comprises an ignitable solid material actuatable to produce combustion products for increasing the temperature and pressure of said stored gas.

Claim 26 (Withdrawn)      An apparatus as set forth in claim 23 wherein said inflator comprises a plurality of MEMS devices including said one MEMS device energizable to produce combustion products for igniting or augmenting said primary inflation fluid source, and further comprising electric circuitry means for energizing selected ones of said plurality of MEMS devices to control the fluid output of said inflator.

Claim 27 (Previously presented)      An apparatus comprising:

an actuatable vehicle occupant protection device;  
an array of individually energizable devices for producing one of inflation fluid and combustion products for actuating said protection device; and

means for energizing selected ones of said array of individually energizable devices,

said means for energizing comprising a base that extends across said array and that includes a plurality of electric heating elements associated one with each of said energizable devices,

said means for energizing further comprising control means for directing electric current into selected ones of said plurality of electric heating elements to energize said selected ones of said energizable devices.

Claim 28 (Cancelled)

Claim 29 (Original)      An apparatus as set forth in claim 27 wherein said heating elements are micro-resistors.

Claim 30 (Original)      An apparatus as set forth in claim 27 wherein said individually energizable devices are pyrotechnic devices ignitable to produce inflation fluid under pressure.

Claim 31 (Withdrawn)      An apparatus as set forth in claim 27 wherein said individually energizable devices are fluid devices energizable to produce inflation fluid under pressure.

Claim 32 (Withdrawn)      An apparatus as set forth in claim 27 wherein said electric heating elements are reactive bridges.

Claim 33 (Withdrawn)      An inflator for inflating an inflatable vehicle occupant protection device, said inflator comprising:

an actuatable first inflation fluid source for providing inflation fluid for inflating said protection device

an actuatable second inflation fluid source for providing inflation fluid for inflating said protection device,

a first initiator comprising at least one microelectromechanical system device (MEMS device) energizable to produce combustion products for actuating said first inflation fluid source; and

a second initiator comprising at least one MEMS device energizable to produce combustion products for actuating said second inflation fluid source, said second initiator being energizable independently of said first initiator.

Claim 34 (Withdrawn)      An inflator as set forth in claim 33 wherein each one of said first and second inflation fluid sources comprises a body of solid propellant.

Claim 35 (Withdrawn)      An inflator as set forth in claim 33 wherein each one of said first and second initiators



comprises a plurality of MEMS devices energizable to produce combustion products including said one MEMS device, and further comprising electric circuitry for energizing selected ones of said plurality of MEMS devices in said first and second initiators to control the fluid output of said inflator.

Claim 36 (Withdrawn)      An inflator as set forth in claim 33 including a housing defining first and second chambers, said first inflation fluid source being disposed in said first chamber and said second inflation fluid source being disposed in said second chamber.

Claim 37 (Withdrawn)      An inflator for inflating an inflatable vehicle occupant protection device, said inflator comprising:

    a first plurality of MEMS devices having outlets presented in a first direction;

    a second plurality of MEMS devices having outlets presented in a second direction different from said first direction;

    said first plurality of MEMS devices being actuatable independently of said second plurality of MEMS devices.

Claim 38 (Withdrawn)      An inflator as set forth in claim 37 wherein said MEMS devices in said first plurality are arranged in a first linear array and said MEMS devices in said

second array are arranged in a linear array extending parallel to said first array.

Claim 39 (Withdrawn)      An inflator as set forth in claim 37 wherein said MEMS devices function as initiators for initiating first and second inflation fluid sources.

Claim 40 (Currently amended)    An apparatus for helping to protect a vehicle occupant, comprising:

an actuatable vehicle occupant protection device;

and

a microelectromechanical system device (MEMS device) energizable to cause actuation of said protection device,

~~An apparatus as set forth in claim 1~~ wherein said MEMS device includes a substrate on which is formed a plurality of electric heating elements, the electric heating elements being energizable to cause actuation of said protection device.

Claim 41 (Previously presented)    An apparatus as set forth in claim 33 wherein each of said plurality of electric heating elements has an associated pyrotechnic charge, said plurality of electric heating elements being selectively energizable, energizing of an electric heating element igniting said associated pyrotechnic charge.

Claim 42 (Cancelled)

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Claim 43 (New) An apparatus as set forth in claim 1 wherein the microelectromechanical system device (MEMS device) has a length of approximately one half of an inch and a width of approximately one half of an inch.

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Claim 44 (New) An apparatus as set forth in claim 1 wherein the microelectromechanical system device (MEMS device) includes a plurality of plenums for storing an energizable fluid source, each of the plurality of plenums having a depth of up to ten millimeters.

Claim 45 (New) An apparatus as set forth in claim 44 wherein each of the plurality of plenums is cylindrical and has a diameter of up to 1.4 millimeters.

Claim 46 (New) An apparatus as set forth in claim 1 comprising a plurality of microelectromechanical system devices (MEMS device), each one of the plurality of microelectromechanical system device (MEMS device) including a plurality of plenums for storing an energizable fluid source.

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